SAMPLING, ANALYSIS, AND MONITORING PLAN (Revised)

20 JEFFERSON AVENUE
ELGIN, ILLINOIS

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1.0 INTRODUCTION

This Sampling, Analysis, and Monitoring Plan (SAMP) was prepared by Conestoga-Rovers & Associates (CRA) and presents information for providing reliable, accurate, and quality data through field sampling activities in support of the Removal Plan for contaminated soil at 20 Jefferson Avenue in Elgin, Illinois (Site). The removal work will involve the excavation and off-site disposal of approximately 1,300 tons of soil contaminated with lead, cadmium, Toxicity Characteristic Leaching Procedure (TCLP) lead, TCLP cadmium, polychlorinated biphenyls (PCBs), and dioxins.

This SAMP presents a brief description of the Site, the project organization and responsibilities, data use and quality assurance/quality control (QA/QC) objectives and specific activities to be performed at the Site.

The specific methods for analysis of collected samples during the Removal Action are discussed in the Quality Assurance Project Plan (QAPP), provided under separate cover.

2.0 BACKGROUND

2.1 SITE INFORMATION

The Site is approximately 1.3 acres and formerly operated as a non-ferrous scrap yard. A removal action was completed in 1995 when 2,600 cubic yards (CY) of contaminated soil was removed. The 1995 work is documented in a report titled "Removal Action Construction Report" (CRA 1995). After the 1995 removal action was completed, scrap operations continued until 2003 or 2004.

The Site was purchased by the City of Elgin in 2004 with plans to develop the property for residential use.

2.2 REMEDIAL OBJECTIVES

The United States Environmental Protection Agency (USEPA) has established the following remedial objectives for the 20 Jefferson Avenue Site:

- Total Polychlorinated Biphenyls (PCBs) 10 mg/kg
- Total Lead 400 mg/kg
- Total Cadmium 390 mg/kg
- TCLP Lead 5 mg/L
- TCLP Cadmium 1 mg/L
- Toxicity Equivalent (TEQ) Dioxin 1 μg/kg

3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Conestoga-Rovers & Associates (CRA) will perform or supervise field sampling efforts and will report directly to the Jefferson Yard Removal Action Group (Group).

A summary of each of the key individuals involved with the project and their responsibilities pertaining to this SAMP is as follows:

Ronald Frehner - Project Manager

- Preparation and review of reports
- Technical representation of project activities
- Managerial guidance to technical group
- Approval of the QAPP and SAMP

Grant Anderson - QA/QC Officer - Analytical Activities

- Systems audits - laboratory activities
- Overview and review field QA/QC
- Coordinate supply of performance evaluation samples
- Review laboratory QA/QC
- Data validation and assessment
- Advise on data corrective action procedures
- Assist in the preparation and review of reports
- QA/QC representation of project activities
- Approval of QAPP and SAMP

Steven Voss - QA Officer - Field Activities

- Lead QA for field activities
- Data assessment of field analyses
- Technical representation of field activities
- Preparation of standard operating procedures (SOPs) for field activities

Independent quality assurance will be provided by the Laboratory Project Managers and QA Officers prior to release of data to CRA.

The parties involved with the Removal Plan and the SAMP and their respective responsibilities are as follows:

- USEPA will perform their regulatory function.
- Jefferson Yard Removal Action Group (Group) is the group of generators that currently consists of Commonwealth Edison, AT&T, and Fermi Research Alliance, LLC (Fermilab).
- Conestoga-Rovers & Associates (CRA) will serve as the consultant for the Group.
- The Construction Contractor (to be selected) will implement the Removal Plan.
- The Analytical Laboratory (Test America) will serve as the contract analytical laboratory and will be responsible for analysis of collected confirmatory samples.

4.0 DATA USE OBJECTIVES

Data from collected soil samples will be used to support activities described in the Removal Plan. Sampling locations and frequencies will be performed as directed by CRA. The analytical parameters and estimated number of samples to be collected and analyzed is presented in Table 4.1.

The existing soil sampling data presented in the Supplemental Investigation Report (CRA 2009a) and the Removal Plan (CRA 2009b) will be used, along with additional sampling results, to classify soil for excavation, handling, processing, and disposal options.

Existing soil sampling data have been used to establish preliminary surface excavation areas, as described in the Removal Plan.

5.0 <u>QUALITY ASURANCE/QUALITY CONTROL (QA/QC) OBJECTIVES</u>

The overall QA/QC objective is to develop and implement field sampling procedures that will provide valid data for verification of removal of impacted soil. The purpose of this section is to address the specific objectives for accuracy, precision, completeness, representativeness, and comparability corresponding to the data use objectives described in Section 4.0.

QA/QC objectives are outlined in Worksheets 11, 20, 34, and 36 of the Quality Assurance Project Plan (QAPP) for the Site (CRA 2009c).

At a minimum, the laboratory will use internal standards and all internal calibrations, and will determine bias for all matrices (% recovery). In addition, for the organic samples collected, one blank, one matrix spike and one matrix spike duplicate will be run at a frequency of 1 per 20 investigation samples for each matrix. For inorganic samples collected, one blank, one laboratory duplicate and one matrix spike duplicate will be run at a frequency of 1 per 20 investigative samples per matrix.

6.0 APPROACH AND SAMPLING METHODOLOGIES

This section contains a description of procedures and protocols for collecting samples related to field activities. Sampling documentation procedures are discussed in Section 7.0. Appropriate containers and preservation protocol specific to each sampling method are presented in this section and summarized on Table 6.1.

In general, soil samples will be collected as directed by the QA field officer. Soil samples will be submitted by courier to the laboratory on the day following collection. Final, verifiable results will be available to the QA field officer within 5 days of receipt by the laboratory. The laboratory will conduct internal QA/QC on 100% of the samples analyzed. CRA will perform data validation on 100% of the collected samples to satisfy the project QA/QC objectives. Discrepancies will be discussed with the lab and brought to the attention of the USEPA.

Reports will be submitted by the laboratory to CRA and will include the analytical data and supporting QA/QC data which will be used for data validation.

USEPA will be notified at least three business days in advance of any sampling activities. USEPA will be allowed to collect spilt and/or duplicate samples during the removal construction. Results of the USEPA collected spilt and/or duplicate samples will be made available within the same turnaround time so as not to induce project delays.

A presentation and discussion of the soil sampling results will be included within the Construction Completion Report.

6.1 CONFIRMATORY SOIL SAMPLING

Confirmatory soil sampling for analysis of PCBs, total lead, total cadmium, TCLP lead, and TCLP cadmium will be conducted following completion of excavation activities. Sidewall confirmatory soil samples will be collected at approximate 25-foot intervals, mid-height along the excavation face, along the outside of the excavation area (adjacent to off-site properties). Bottom confirmatory soil samples will be collected from the excavation area on an approximate 25-foot spaced grid. All confirmatory soil samples will be discrete grab samples. The approximate locations of the confirmatory soil sampling points are depicted on Figure 6.1.

6.2 SOIL SAMPLING PROCEDURES

Grab samples will be collected from surface and subsurface soils for confirmation of achievement of soil cleanup criteria following soil excavation. Soil sampling will be conducted in accordance with EPA/540/P91/006 "Compendium of ERT Soil Sampling and Surface Geophysics Procedures" - Soil Sampling: SOP #2012 (USEPA 1991a), which is presented in Appendix A.

6.3 DECONTAMINATION OF SAMPLING EQUIPMENT

The decontamination of equipment used for the collection of samples will be an integral part of the sampling program to prevent the cross-contamination of samples and provide reliable and accurate data results. Sampling equipment will be decontaminated in accordance with EPA/540/P-91/008 "Compendium of ERT Soil Sampling and Surface Geophysics Procedures" - Sampling Equipment Decontamination: SOP #2006 (USEPA 1991a), which is presented in Appendix B.

7.0 QUALITY ASSURANCE REQUIREMENTS

This section describes QA requirements based on the QA/QC objective described in Section 5.0 and the QAPP.

7.1 DOCUMENTATION CONTROL

Chain-of-custody protocols will follow those described in "NEIC Policies and Procedures," EPA-330/9-78-DDI-R (USEPA 1991b). This custody procedure is presented as three parts encompassing sample collection, laboratory analysis, and final evidence files. Final evidence files, including all originals of laboratory reports and purge files, are maintained under document control in a secure area.

A sample or evidence file is under custody if:

- It is in an individual's personal possession;
- It is an individual's view, after being in their possession;
- It is an individual's possession and placed in a secured location; or
- It is in a designated secure area.

The sample packaging and shipment procedures summarized below are intended to provide that the samples will arrive at the laboratory with the chain-of-custody intact.

7.1.1 FIELD PROCEDURES

The field sampler is personally responsible for the care and custody of the samples until their chain-of-custody is transferred or properly dispatched. As few people as possible should handle the samples.

Sample labels are to be completed for each sample using waterproof ink unless prohibited by weather conditions. A unique sample numbering system will be used to identify each collected sample. This system will provide a tracking number to allow retrieval and cross-referencing of sample information. A listing of the sample identification numbers with written descriptions of sample location, type, and date will be maintained by CRA field personnel. A typical example of a sample numbering system to be used is as follows:

Example	S-090218-AA-XXX		
where:	S	-	Designates sample type (e.g., S - Soil)
	090218	-	Date of collection (YYMMDD)
	AA	-	Sampler initials
	XXX	-	Sequential number starting with 001

7.1.2 FIELD LOGBOOKS/DOCUMENTATION

The field logbook will provide the means of recording the data collecting activities. As such, entries will be described in as much detail as possible so that persons going to the Site could reconstruct a particular situation without reliance on memory.

The title page of each logbook will contain the following:

- Person to whom the logbook is assigned;
- Logbook number;
- Project name;
- Project start date; and
- End date.

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather, names of all sampling team members present, level of personal protection being used, and the signature of the person making the entry will be entered. The names of visitors to the Site, field sampling or investigation team personnel, and the purpose of their visit will also be recorded in the field logbook.

Measurements made and samples collected will be recorded. All entries will be made in ink and no erasures will be made. If an incorrect entry is make, the information will be crossed out with a single strike mark and initialed. Whenever a sample is collected or a measurement is made, a detailed description of the location of the station, which includes compass and distance taken of the station, if any, will also be noted. All equipment used to make measurements will be identified, along with the date of calibration, if appropriate.

Samples will be collected following the sampling procedures documented in Section 6.0 of this SAMP. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, sample volume, and number of containers. A sample identification number will be assigned during sample collection. Field QC samples (blanks and duplicates), which will receive an entirely separate sample identification number, will be submitted blind to avoid laboratory bias of field QC samples.

7.1.3 TRANSFER OF CUSTODY AND SHIPMENT PROCEDURES

Samples are to be accompanied by a properly completed chain-of-custody form. The sample numbers and locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving the samples will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to the laboratory, or to/from a secure storage area.

Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in each sample box or cooler. Shipping containers will be secured with strapping tape and custody seals for shipment to the laboratory. The preferred procedure includes use of a custody seal attached to the front right and back left of the cooler. The custody seals are covered with clear plastic tape. The cooler is strapped shut with strapping tape in at least two locations.

Whenever samples are split with a government agency, a separate chain-of-custody record is prepared for those samples and marked to indicate with whom the samples are being split. The person relinquishing the samples to the facility or agency should request the representative's signature acknowledging sample receipt. If the representative is unavailable or refuses, this is noted in the "Received By" space.

All shipments will be accompanied by the chain-of-custody record identifying the contents. The original record will accompany the shipment, and the pink and goldenrod copies will be retained by the sampler for returning to the field office.

If the samples are sent by common carrier, a bill of lading should be used. Receipts of bills of lading will be retained as part of the permanent documentation. Commercial carriers are not required to sign off on the custody form as long as the custody forms are sealed inside the sample cooler and the custody seals remain intact.

All samples will be transported and shipped in accordance with applicable DOT regulations.

7.2 CHAIN-OF-CUSTODY PROCEDURES

The sample custodian will assign a unique number to each incoming sample for use in the laboratory. The unique number and customer number will then be entered into the sample receiving log. The laboratory date of receipt will also be noted.

Laboratory custody procedures and document control for those samples analyzed by the laboratory will be carried out as specified in the QAPP.

7.3 HOLDING TIMES

After the sample custodian has prepared the log book, the chain-of-custody forms will be checked to ensure that all samples are stored in the appropriate locations. All samples will be stored within an access controlled location and will be maintained at 4°C until completion of all analytical work or, as a minimum, for 30 days after receipt of the final report by CRA. CRA must be notified by the laboratory at least 5 days prior to sample disposal.

7.4 FINAL EVIDENCE FILES CUSTODY PROCEDURES

Evidential files for the entire project will be maintained by CRA and will consist of the following:

- Project plan;
- Project log books;
- Field data records;
- Sample identification documents (to include field logbooks and cross-reference memos);
- Chain-of-custody records;

- Preliminary data;
- Correspondence;
- References and literature;
- Final data packages;
- Miscellaneous documents including photos, maps, drawings, etc.; and
- Final report.

The evidentiary file materials will be the responsibility of the evidentiary file custodian with respect to maintenance and document removal.

The laboratory will be responsible for maintaining analytical log books and laboratory data. Raw laboratory data files will be inventoried and maintained by the laboratory for a period of five years, at which time CRA will advise the laboratory regarding the need for additional storage.

7.5 CALIBRATION PROCEDURES AND FREQUENCY

This section describes procedures for maintaining the accuracy for all the instruments and measuring equipment which are used for conducting field tests and sampling. These instruments and equipment should be calibrated in accordance with the manufacturer's recommendations.

Equipment to be used during the field sampling will be examined to certify that it is in operating condition. This includes checking the manufacturer's operating manual for each instrument to determine the maintenance requirements. Field notes from previous sampling trips will be reviewed so that the notation on any prior equipment problem are not overlooked, and all necessary repairs to equipment have been carried out.

Calibration of the field instruments will be conducted prior to the collection of each sample as directed by the QA field officer. The field equipment will be maintained, calibrated, and operated in a manner consistent with the manufacturer's guidelines and USEPA standard methods.

7.6 SAMPLE BLANKS

Quality control of field sampling will involve collecting field duplicates and field (rinsate) blanks in accordance with the applicable procedures described in Section 6.0 and the level of effort indicated on Table 4.1.

Rinsate blanks, field duplicates, and matrix spike samples will be collected and analyzed to assess the quality of the data resulting from field sampling. Rinsate blanks will be submitted to the analytical laboratories to provide the means to assess the quality of the data resulting from field sampling.

Rinsate blank samples are analyzed to check for procedural contamination at the Site which may cause sample contamination. Rinsate blanks are samples of reagent grade water that have been used to rinse the sampling equipment. These blanks are collected after the equipment decontamination and prior to re-using the sampling equipment.

Field duplicate samples are analyzed to check for sampling and analytical reproducibility. Field duplicate samples are obtained by alternately filling sample containers from the same sampling device for each parameter.

Matrix spikes provide information about the effect of the sample matrix on the preparation and measurement methodology. Matrix spikes are samples to which predetermined quantities of stock solutions of certain analytes are added prior to sample preparation and analysis.

The number of field QA/QC samples to be collected on-site is summarized on Table 4.1.

7.7 FIELD AUDITS

Internal audits of field activities (sampling and measurement) may be conducted by the CRA QA Officer - Field Activities. The audits would include examination of field sampling records, field instrument operating records, sample collection, handling and packaging in compliance with the established procedures, maintenance of QA procedures, chain-of-custody, etc. These audits would be conducted to correct deficiencies and to verify that QA procedures are maintained throughout the project. The audits would involve review of field measurement records, instrumentation calibration records, and sample documentation. No internal field audit is scheduled at this time.

8.0 DATA VALIDATION

Data validation procedures are discussed in the QAPP (Worksheets 34 - 36).

9.0 QUALITY ASSURANCE REPORTS

CRA will receive monthly reports on the performance of the sampling activities and data quality. A report will also be submitted at the conclusion of the project. These reports will achieve compliance with the UAO.

Minimally, these reports will include:

- Assessment of measurement quality indicators (i.e. data accuracy, precision and completeness);
- Results of system audits; and
- QA problems and recommended solutions.

The CRA QA/QC Officer - Analytical Activities will be responsible within the organizational structure for preparing these reports. The final report for the project will also include a separate QA section which will summarize data quality information contained in the periodic QA/QC reports to management and details an overall data assessment and validation in accordance with the data quality objectives outlined in the QAPP.

10.0 REFERENCES

Conestoga-Rovers & Associates (CRA). 1995. Removal Action Construction Report - Elgin Salvage and Supply Site, Elgin, Illinois. May 1995

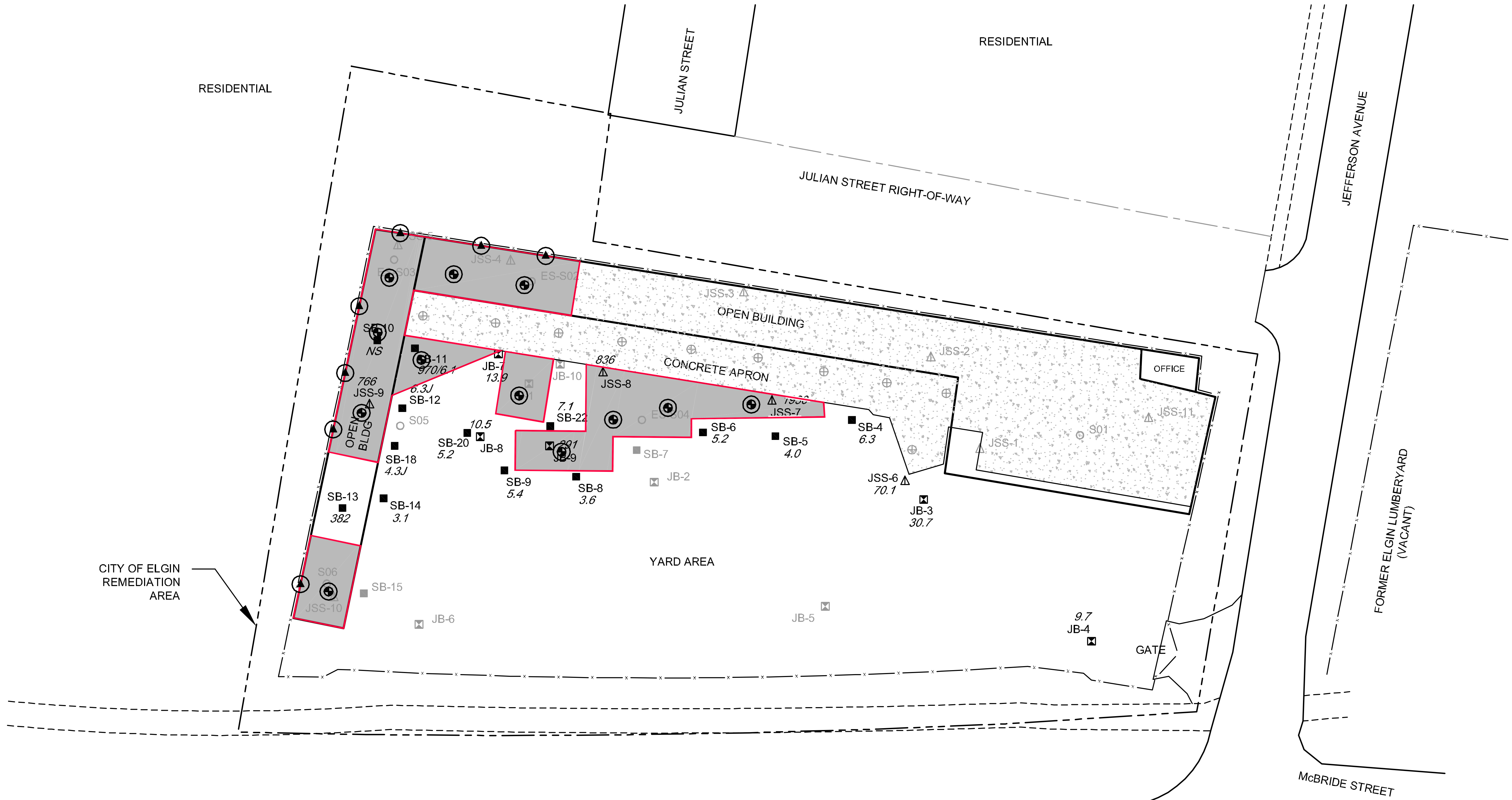
CRA. 2009a. Supplemental Investigation Report - 20 Jefferson Avenue, Elgin, Illinois. January 2009.

CRA. 2009b. Removal Plan - 20 Jefferson Avenue, Elgin, Illinois. February 2009.

CRA. 2009c. Quality Assurance Project Plan - 20 Jefferson Avenue, Elgin, Illinois. February 2009.

United States Environmental Protection Agency (USEPA). 1991a. Compendium of ERT Waste Sampling Procedures - SOP #2012. EPA/540/P-91/008.

USEPA. 1991b. NEIC Policies and Procedures. EPA-330/9-78-DDI-R.



0 20 40ft

LEGEND

⊠	SOIL BORING (TERRACON AUGUST 2004)
△	SURFACE SOIL SAMPLE (TERRACON DECEMBER 2007)
○	SAMPLE LOCATION (WESTON APRIL 2008)
⊕	SAMPLE LOCATION (CRA DECEMBER 1994)
■	SAMPLE LOCATION (CRA NOVEMBER 2008)
ND	NOT DETECTED
291	TOTAL LEAD CONCENTRATION IN mg/Kg
970/6.1	TOTAL LEAD (mg/Kg)/TCLP (mg/L) CONCENTRATION
NS	NOT SAMPLED
▲ (circled)	SIDEWALL CONFIRMATORY SAMPLING LOCATIONS
◉	BOTTOM CONFIRMATORY SAMPLING LOCATIONS
solid line	SITE BUILDING (ROOF)
dashed line	REMEDIATION AREA
grey area	EXCAVATION AREA
stippled area	CONCRETE

figure 6.1

CONFIRMATORY SAMPLING LOCATIONS
20 JEFFERSON AVENUE
Elgin, Illinois

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TABLE 4.1

SUMMARY OF SAMPLING AND ANALYSIS PROGRAM
20 JEFFERSON AVENUE

Sample Matrix	*Lab Parameters*	*Lab Method*	*Estimated Number of Samples*	*Field (Rinsate) Blanks*	*Field Duplicates*	*MS/MSD Set*
Soil	PCBs	SW 8082	20	1:10	1:10	1:20
	Total Lead	SW 6010B	20	1:10	1:10	1:20
	Total Cadmium	SW 6010B	20	1:10	1:10	1:20
	TCLP - Lead	SW 1311/6010B	20	1:10	1:10	1:20
	TCLP - Cadmium	SW 1311/6010B	20	1:10	1:10	1:20

TABLE 6.1

CONTAINER, PRESERVATION, SHIPPING, AND PACKAGING REQUIREMENTS
20 JEFFERSON AVENUE

Analysis	***Container***	***Preservation***	***Holding Time*** (1)	***Sample Volume***	***Shipping***	***Packaging***
Soil						
PCB, Total Lead, Total Cadmium, TCLP Lead, TCLP Cadmium	Two 4-ounce wide-mouth glass jars	Chilled, 4°C	PCB - 14 days to extraction; 40 days to analysis, Lead, Cadmium - 6 months to analysis, TCLP Lead, TCLP Cadmium - 6 months to extract; 6 months to analysis	Fill to neck	Courier	Bubble Pack or equivalent

Notes:
(1) Holding time periods are based from time of sample collection to completion of analysis.

APPENDIX A

SOP #2012 - SOIL SAMPLING

United States
Environmental Protection
Agency

Office of Solid Waste and
Emergency Response
Washington DC 20460

EPA 540 P-91 006
January 1991

EPA

Compendium of ERT Soil Sampling and Surface Geophysics Procedures

2.0 SOIL SAMPLING: SOP #2012

2.1 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to describe the procedures for collecting representative soil samples. Analysis of soil samples may determine whether concentrations of specific soil pollutants exceed established action levels, or if the concentrations of soil pollutants present a risk to public health, welfare, or the environment.

2.2 METHOD SUMMARY

Soil samples may be collected using a variety of methods and equipment. The methods and equipment used are dependent on the depth of the desired sample, the type of sample required (disturbed versus undisturbed), and the type of soil. Near-surface soils may be easily sampled using a spade, trowel, and scoop. Sampling at greater depths may be performed using a hand auger, a trier, a split-spoon, or, if required, a backhoe.

2.3 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Chemical preservation of solids is not generally recommended. Refrigeration to 4°C, supplemented by a minimal holding time, is usually the best approach.

2.4 INTERFERENCES AND POTENTIAL PROBLEMS

There are two primary interferences or potential problems associated with soil sampling. These include cross-contamination of samples and improper sample collection. Cross-contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. If this is not possible or practical, then decontamination of sampling equipment is necessary. Improper sample collection can involve using contaminated equipment, disturbance of the matrix resulting in compaction of the sample, or inadequate homogenization of the samples where required, resulting in variable, non-representative results.

2.5 EQUIPMENT/APPARATUS

- sampling plan
- maps/plot plan
- safety equipment, as specified in the health and safety plan
- compass
- tape measure
- survey stakes or flags
- camera and film
- stainless steel, plastic, or other appropriate homogenization bucket or bowl
- 1-quart mason jars w/Teflon liners
- Ziploc plastic bags
- logbook
- labels
- chain of custody forms and seals
- field data sheets
- cooler(s)
- ice
- decontamination supplies/equipment
- canvas or plastic sheet
- spade or shovel
- spatula
- scoop
- plastic or stainless steel spoons
- trowel
- continuous flight (screw) auger
- bucket auger
- post hole auger
- extension rods
- T-handle
- sampling trier
- thin-wall tube sampler
- Vehimeyer soil sampler outfit
  - tubes
  - points
  - drive head
  - drop hammer
  - puller jack and grip
- backhoe

2.6 REAGENTS

Reagents are not used for the preservation of soil samples. Decontamination solutions are specified in

ERT SOP #2006, Sampling Equipment Decontamination.

2.7 PROCEDURES

2.7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and which equipment and supplies are required.

2. Obtain necessary sampling and monitoring equipment.

3. Decontaminate or preclean equipment, and ensure that it is in working order.

4. Prepare schedules, and coordinate with staff, client, and regulatory agencies, if appropriate.

5. Perform a general site survey prior to site entry in accordance with the site-specific health and safety plan.

6. Use stakes, buoys, or flagging to identify and mark all sampling locations. Consider specific site factors, including extent and nature of contaminant, when selecting sample location. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All staked locations will be utility-cleared by the property owner prior to soil sampling.

2.7.2 Sample Collection

Surface Soil Samples

Collect samples from near-surface soil with tools such as spades, shovels, and scoops. Surface material can be removed to the required depth with this equipment, then a stainless steel or plastic scoop can be used to collect the sample.

This method can be used in most soil types but is limited to sampling near surface areas. Accurate, representative samples can be collected with this procedure depending on the care and precision demonstrated by the sampling team member. The use of a flat, pointed mason trowel to cut a block of the desired soil can be helpful when undisturbed profiles are required. A stainless steel scoop, lab spoon, or plastic spoon will suffice in most other applications. Avoid the use of devices plated with chrome or other materials. Plating is particularly common with garden implements such as potting trowels.

Follow these procedures to collect surface soil samples.

1. Carefully remove the top layer of soil or debris to the desired sample depth with a pre-cleaned spade.

2. Using a pre-cleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of soil from the area which came in contact with the spade.

3. If volatile organic analysis is to be performed, transfer a portion of the sample directly into an appropriate, labeled sample container(s) with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap(s) tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled container(s) and secure the cap(s) tightly.

Sampling at Depth with Augers and Thin-Wall Tube Samplers

This system consists of an auger, a series of extensions, a "T" handle, and a thin-wall tube sampler (Appendix A, Figure 1). The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The sample may be collected directly from the auger. If a core sample is to be collected, the auger tip is then replaced with a thin-wall tube sampler. The system is then lowered down the borehole, and driven into the soil at the completion depth. The system is withdrawn and the core collected from the thin-wall tube sampler.

Several types of augers are available. These include: bucket, continuous flight (screw), and posthole augers. Bucket augers are better for direct sample recovery since they provide a large volume of sample in a short time. When continuous flight augers are used, the sample can be collected directly from the flights, which are usually at 5-feet intervals. The continuous flight augers are satisfactory for use when a composite of the complete soil column is desired. Posthole augers have limited utility for sample collection as they are designed to cut through fibrous, rooted, swampy soil.

Follow these procedures for collecting soil samples with the auger and a thin-wall tube sampler.

1. Attach the auger bit to a drill rod extension, and attach the "T" handle to the drill rod.

2. Clear the area to be sampled of any surface debris (e.g., twigs, rocks, litter). It may be advisable to remove the first 3 to 6 inches of surface soil for an area approximately 6 inches in radius around the drilling location.

3. Begin augering, periodically removing and depositing accumulated soils onto a plastic sheet spread near the hole. This prevents accidental brushing of loose material back down the borehole when removing the auger or adding drill rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.

4. After reaching the desired depth, slowly and carefully remove the auger from boring. When sampling directly from the auger, collect sample after the auger is removed from boring and proceed to Step 10.

5. Remove auger tip from drill rods and replace with a pre-cleaned thin-wall tube sampler. Install proper cutting tip.

6. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the soil. Care should be taken to avoid scraping the borehole sides. Avoid hammering the drill rods to facilitate coring as the vibrations may cause the boring walls to collapse.

7. Remove the tube sampler, and unscrew the drill rods.

8. Remove the cutting tip and the core from the device.

9. Discard the top of the core (approximately 1 inch), as this represents material collected before penetration of the layer of concern. Place the remaining core into the appropriate labeled sample container(s). Sample homogenization is not required.

10. If volatile organic analysis is to be performed, transfer a portion of the sample directly into an appropriate, labeled sample container(s) with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap(s) tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into the appropriate, labeled container(s) and secure the cap(s) tightly.

11. If another sample is to be collected in the same hole, but at a greater depth, reattach the auger bit to the drill and assembly, and follow steps 3 through 11, making sure to decontaminate the auger and tube sampler between samples.

12. Abandon the hole according to applicable state regulations. Generally, shallow holes can simply be backfilled with the removed soil material.

Sampling at Depth with a Trier

The system consists of a trier, and a "T" handle. The auger is driven into the soil to be sampled and used to extract a core sample from the appropriate depth.

Follow these procedures to collect soil samples with a sampling trier.

1. Insert the trier (Appendix A, Figure 2) into the material to be sampled at a 0° to 45° angle from horizontal. This orientation minimizes the spillage of sample.

2. Rotate the trier once or twice to cut a core of material.

3. Slowly withdraw the trier, making sure that the slot is facing upward.

4. If volatile organic analysis is to be performed, transfer a portion of the sample directly into an appropriate, labeled sample container(s) with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap(s) tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly.

Sampling at Depth with a Split Spoon (Barrel) Sampler

The procedure for split spoon sampling describes the collection and extraction of undisturbed soil cores of 18 or 24 inches in length. A series of consecutive cores may be extracted with a split spoon sampler to give a complete soil column profile, or an auger may be used to drill down to the desired depth for sampling. The split spoon is then driven to its sampling depth through the bottom of the augured hole and the core extracted.

When split tube sampling is performed to gain geologic information, all work should be performed in accordance with ASTM D 1586-67 (reapproved 1974).

Follow these procedures for collecting soil samples with a split spoon.

1. Assemble the sampler by aligning both sides of the barrel and then screwing the bit onto the bottom and the heavier head piece onto the top.

2. Place the sampler in a perpendicular position on the sample material.

3. Using a sledge hammer or well ring, if available, drive the tube. Do not drive past the bottom of the head piece or compression of the sample will result.

4. Record in the site logbook or on field data sheets the length of the tube used to penetrate the material being sampled, and the number of blows required to obtain this depth.

5. Withdraw the sampler, and open by unscrewing the bit and head and splitting the barrel. If a split sample is desired, a cleaned, stainless steel knife should be used to divide the tube contents in half, longitudinally. This sampler is typically available in diameters of 2 and 3 1/2 inches. However, in order to obtain the required sample volume, use of a larger barrel may be required.

6. Without disturbing the core, transfer it to an appropriate labeled sample container(s) and seal tightly.

Test Pit/Trench Excavation

These relatively large excavations are used to remove sections of soil, when detailed examination of soil characteristics (horizontal structure, color, etc.) are required. It is the least cost effective sampling method due to the relatively high cost of backhoe operation.

Follow these procedures for collecting soil samples from test pit/trench excavations.

1. Prior to any excavation with a backhoe, it is important to ensure that all sampling locations are clear of utility lines and poles (subsurface as well as above surface).

2. Using the backhoe, dig a trench to approximately 3 feet in width and approximately 1 foot below the cleared sampling location. Place removed or excavated soils on plastic sheets. Trenches greater than 5 feet deep must be sloped or protected by a shoring system, as required by OSHA regulations.

3. Use a shovel to remove a 1- to 2-inch layer of soil from the vertical face of the pit where sampling is to be done.

4. Take samples using a trowel, scoop, or coring device at the desired intervals. Be sure to scrape the vertical face at the point of sampling

to remove any soil that may have fallen from above, and to expose fresh soil for sampling. In many instances, samples can be collected directly from the backhoe bucket.

5. If volatile organic analysis is to be performed, transfer a portion of the sample directly into an appropriate, labeled sample container(s) with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap(s) tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled container(s) and secure the cap(s) tightly.

6. Abandon the pit or excavation according to applicable state regulations. Generally, shallow excavations can simply be backfilled with the removed soil material.

2.8 CALCULATIONS

This section is not applicable to this SOP.

2.9 QUALITY ASSURANCE/ QUALITY CONTROL

There are no specific quality assurance activities which apply to the implementation of these procedures. However, the following QA procedures apply:

- All data must be documented on field data sheets or within site logbooks.

- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.

2.10 DATA VALIDATION

This section is not applicable to this SOP.

2.11 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA, and specific health and safety procedures.

APPENDIX B

SOP #2006 - SAMPLING EQUIPMENT DECONTAMINATION

United States
Environmental Protection
Agency

Office of Solid Waste and
Emergency Response
Washington DC 20460

EPA 540 P-91 006
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EPA

Compendium of ERT Soil Sampling and Surface Geophysics Procedures

1.0 SAMPLING EQUIPMENT DECONTAMINATION: SOP #2006

1.1 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes methods used for preventing or reducing cross-contamination, and provides general guidelines for sampling equipment decontamination procedures at a hazardous waste site. Preventing or minimizing cross-contamination in sampled media and in samples is important for preventing the introduction of error into sampling results and for protecting the health and safety of site personnel.

Removing or neutralizing contaminants that have accumulated on sampling equipment ensures protection of personnel from permeating substances, reduces or eliminates transfer of contaminants to clean areas, prevents the mixing of incompatible substances, and minimizes the likelihood of sample cross-contamination.

1.2 METHOD SUMMARY

Contaminants can be physically removed from equipment, or deactivated by sterilization or disinfection. Gross contamination of equipment requires physical decontamination, including abrasive and non-abrasive methods. These include the use of brushes, air and wet blasting, and high-pressure water cleaning, followed by a wash/rinse process using appropriate cleaning solutions. Use of a solvent rinse is required when organic contamination is present.

1.3 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

This section is not applicable to this SOP.

1.4 INTERFERENCES AND POTENTIAL PROBLEMS

- The use of distilled/deionized water commonly available from commercial vendors may be acceptable for decontamination of sampling equipment provided that it has been verified by laboratory analysis to be analyte free.
- An untreated potable water supply is not an acceptable substitute for tap water. Tap water may be used from any municipal water treatment system for mixing of decontamination solutions.
- Acids and solvents utilized in the decontamination sequence pose the health and safety risks of inhalation or skin contact, and raise shipping concerns of permeation or degradation.
- The site work plan must address disposal of the spent decontamination solutions.
- Several procedures can be established to minimize contact with waste and the potential for contamination. For example:
  - Stress work practices that minimize contact with hazardous substances.
  - Use remote sampling, handling, and container-opening techniques when appropriate.
  - Cover monitoring and sampling equipment with protective material to minimize contamination.
  - Use disposable outer garments and disposable sampling equipment when appropriate.

1.5 EQUIPMENT/APPARATUS

- appropriate personal protective clothing
- non-phosphate detergent
- selected solvents
- long-handled brushes
- drop cloths/plastic sheeting
- trash container
- paper towels
- galvanized tubs or buckets
- tap water

- distilled/deionized water
- metal/plastic containers for storage and disposal of contaminated wash solutions
- pressurized sprayers for tap and deionized/distilled water
- sprayers for solvents
- trash bags
- aluminum foil
- safety glasses or splash shield
- emergency eyewash bottle

1.6 REAGENTS

There are no reagents used in this procedure aside from the actual decontamination solutions and solvents. In general, the following solvents are utilized for decontamination purposes:

- 10% nitric acid(1)
- acetone (pesticide grade)(2)
- hexane (pesticide grade)(2)
- methanol

(1) Only if sample is to be analyzed for trace metals.
(2) Only if sample is to be analyzed for organics.

1.7 PROCEDURES

As part of the health and safety plan, develop and set up a decontamination plan before any personnel or equipment enter the areas of potential exposure. The equipment decontamination plan should include:

- the number, location, and layout of decontamination stations
- which decontamination apparatus is needed
- the appropriate decontamination methods
- methods for disposal of contaminated clothing, apparatus, and solutions

1.7.1 Decontamination Methods

All personnel, samples, and equipment leaving the contaminated area of a site must be decontaminated. Various decontamination methods will either physically remove contaminants, inactivate contaminants by disinfection or sterilization, or do both.

In many cases, gross contamination can be removed by physical means. The physical decontamination techniques appropriate for equipment decontamination can be grouped into two categories: abrasive methods and non-abrasive methods.

Abrasive Cleaning Methods

Abrasive cleaning methods work by rubbing and wearing away the top layer of the surface containing the contaminant. The following abrasive methods are available:

- Mechanical: Mechanical cleaning methods use brushes of metal or nylon. The amount and type of contaminants removed will vary with the hardness of bristles, length of brushing time, and degree of brush contact.

- Air Blasting: Air blasting is used for cleaning large equipment, such as bulldozers, drilling rigs or auger bits. The equipment used in air blast cleaning employs compressed air to force abrasive material through a nozzle at high velocities. The distance between the nozzle and the surface cleaned, as well as the pressure of air, the time of application, and the angle at which the abrasive strikes the surface, determines cleaning efficiency. Air blasting has several disadvantages: it is unable to control the amount of material removed, it can aerate contaminants, and it generates large amounts of waste.

- Wet Blasting: Wet blast cleaning, also used to clean large equipment, involves use of a suspended fine abrasive delivered by compressed air to the contaminated area. The amount of materials removed can be carefully controlled by using very fine abrasives. This method generates a large amount of waste.

Non-Abrasive Cleaning Methods

Non-abrasive cleaning methods work by forcing the contaminant off of a surface with pressure. In general, less of the equipment surface is removed using non-abrasive methods. The following non-abrasive methods are available:

- High-Pressure Water: This method consists of a high-pressure pump, an operator-controlled directional nozzle, and a high pressure hose. Operating pressure usually ranges from 340 to 680 atmospheres (atm) which relates to flow rates of 20 to 140 liters per minute.

- Ultra-High-Pressure Water: This system produces a pressurized water jet (from 1,000 to 4,000 atm). The ultra-high-pressure spray removes tightly-adhered surface film. The water velocity ranges from 500 m/sec (1,000 atm) to 900 m/sec (4,000 atm). Additives can enhance the method. This method is not applicable for hand-held sampling equipment.

Disinfection/Rinse Methods

- Disinfection: Disinfectants are a practical means of inactivating infectious agents.

- Sterilization: Standard sterilization methods involve heating the equipment. Sterilization is impractical for large equipment.

- Rinsing: Rinsing removes contaminants through dilution, physical attraction, and solubilization.

1.7.2 Field Sampling Equipment Cleaning Procedures

Solvent rinses are not necessarily required when organics are not a contaminant of concern and may be eliminated from the sequence specified below. Similarly, an acid rinse is not required if analysis does not include inorganics.

1. Where applicable, follow physical removal procedures specified in section 1.7.1.

2. Wash equipment with a non-phosphate detergent solution.

3. Rinse with tap water.

4. Rinse with distilled/deionized water.

5. Rinse with 10% nitric acid if the sample will be analyzed for trace organics.

6. Rinse with distilled/deionized water.

7. Use a solvent rinse (pesticide grade) if the sample will be analyzed for organics.

8. Air dry the equipment completely.

9. Rinse again with distilled/deionized water.

Selection of the solvent for use in the decontamination process is based on the contaminants present at the site. Use of a solvent is required when organic contamination is present on-site. Typical solvents used for removal of organic contaminants include acetone, hexane, or water. An acid rinse step is required if metals are present on-site. If a particular contaminant fraction is not present at the site, the nine-step decontamination procedure listed above may be modified for site specificity. The decontamination solvent used should not be among the contaminants of concern at the site.

Table 1 lists solvent rinses which may be required for elimination of particular chemicals. After each solvent rinse, the equipment should be air dried and rinsed with distilled/deionized water.

Sampling equipment that requires the use of plastic tubing should be disassembled and the tubing replaced with clean tubing, before commencement of sampling and between sampling locations.

1.8 CALCULATIONS

This section is not applicable to this SOP.

1.9 QUALITY ASSURANCE/ QUALITY CONTROL

One type of quality control sample specific to the field decontamination process is the rinsate blank. The rinsate blank provides information on the effectiveness of the decontamination process employed in the field. When used in conjunction with field blanks and trip blanks, a rinsate blank can detect contamination during sample handling, storage and sample transportation to the laboratory.

Table 1: Recommended Solvent Rinse for Soluble Contaminants

SOLVENT	SOLUBLE CONTAMINANTS
Water	• Low-chain hydrocarbons • Inorganic compounds • Salts • Some organic acids and other polar compounds
Dilute Acids	• Basic (caustic) compounds • Amines • Hydrazines
Dilute Bases -- for example, detergent and soap	• Metals • Acidic compounds • Phenol • Thiols • Some nitro and sulfonic compounds
Organic Solvents[(1)] - for example, alcohols, ethers, ketones, aromatics, straight-chain alkanes (e.g., hexane), and common petroleum products (e.g., fuel, oil, kerosene)	• Nonpolar compounds (e.g., some organic compounds)

[(1)] - WARNING: Some organic solvents can permeate and/or degrade protective clothing.

A rinsate blank consists of a sample of analyte-free (i.e, deionized) water which is passed over and through a field decontaminated sampling device and placed in a clean sample container.

Rinsate blanks should be run for all parameters of interest at a rate of 1 per 20 for each parameter, even if samples are not shipped that day. Rinsate blanks are not required if dedicated sampling equipment is used.

1.10 DATA VALIDATION

This section is not applicable to this SOP.

1.11 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA and specific health and safety procedures.

Decontamination can pose hazards under certain circumstances even though performed to protect health and safety. Hazardous substances may be incompatible with decontamination methods. For example, the decontamination solution or solvent may react with contaminants to produce heat, explosion, or toxic products. Decontamination methods may be incompatible with clothing or equipment; some solvents can permeate or degrade protective clothing. Also, decontamination solutions and solvents may pose a direct health hazard to workers through inhalation or skin contact, or if they combust.

The decontamination solutions and solvents must be determined to be compatible before use. Any method that permeates, degrades, or damages personal protective equipment should not be used. If decontamination methods pose a direct health hazard, measures should be taken to protect personnel or the methods should be modified to eliminate the hazard.